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Short communication

Chromosome Observations in Species of *Cayratia* (Vitaceae). II. Intraspecific Polyploidy in *C. trifolia*

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The chromosome numbers of two species of *Cayratia* (Vitaceae) are reported. *Cayratia japonica* var. *mollis* had a diploid number of $2n$=40, while *C. trifolia* was found to have both diploids of $2n$=40 and tetraploids of $2n$=80.

Key words: *Cayratia japonica* var. *mollis*, *Cayratia trifolia*, chromosome number, intraspecific polyploidy, Vitaceae

Polyploidization is one of the important accelerators of plant evolution. Since we discovered triploids with $2n$=60 (x=20) in *Cayratia japonica* (Thunb.) Gagn. (Okada *et al.* 2003a), we have examined the chromosome numbers of other species of *Cayratia* allied to *C. japonica* to try to understand their origin (Okada *et al.* 2003b). With the exception of *C. japonica*, which occurs in Japan, members of the genus *Cayratia* are widely distributed from Africa, India and China to the Pacific region. The chromosome numbers of only eight of about 45 species are known (Okada *et al.* 2003b). It is therefore difficult to discuss the evolutionary trend in chromosome numbers in the species related to *C. japonica*, or in the genus as a whole. Fortunately, we have obtained materials of two species for which no chromosome information was known and we are able to report on the interesting cytological aspects of one of them.

Living stock of *Cayratia japonica* (Thunb.) Gagn. var. *mollis* (Wall.) Momiyama was collected from a roadside near the bridge crossing Sg. (River) Sunsuron, Tambunan, 71km-72km SE of Kota Kinabalu, at about 660 m in Sabah, Malaysia (voucher specimen: *Okada 5662*), and of *C. trifolia* (L.) Domin from two localities; the campus of the Indonesian Institute of Sciences (LIPI), Jakarta, Java, Indonesia (voucher specimen: *Okada 5690*) and Kasongan Lama, Katingan Hilir Subdist., Katingan Dist., about 75 km NW of Palangka Raya, Central Kalimantan, 01°54'42"S, 113°22'54"E, at about 30 m elevation, Indonesia (voucher specimen: *Okada et al. 1*). They were transplanted to the greenhouse of the Botanical Gardens, Faculty of Science, Osaka City University. Voucher specimens will be deposited in BO (Herbarium Bogoriense) and KYO (Kyoto University). Chromosomes were observed by the same methods as in a previous

report (Okada 1984). The chromosome numbers of both *C. japonica* var. *mollis* and *C. trifolia* have not been reported previously. Pollen fertility was estimated by the same method as in a previous report (Okada *et al.* 2003a).

We determined the chromosome number of *Cayratia japonica* var. *mollis* to be $2n = 40$ (Fig. 1A, D). The Chromosome varied in size from about 1.0 - 2.5 μm, or nearly the same as in diploid individuals of *C. japonica* var. *japonica* (Okada *et al.* 2003a). Pollen fertility was 73%. For *C. trifolia* we counted $2n = 40$ for the individuals collected in Jakarta (Fig. 1B, E), and $2n = 80$ for the individuals collected at Kasongan Lama (Fig. 1C, F). The chromosomes varied in size from about 1.0 - 2.0 μm, which is somewhat smaller than those of *C. japon-*

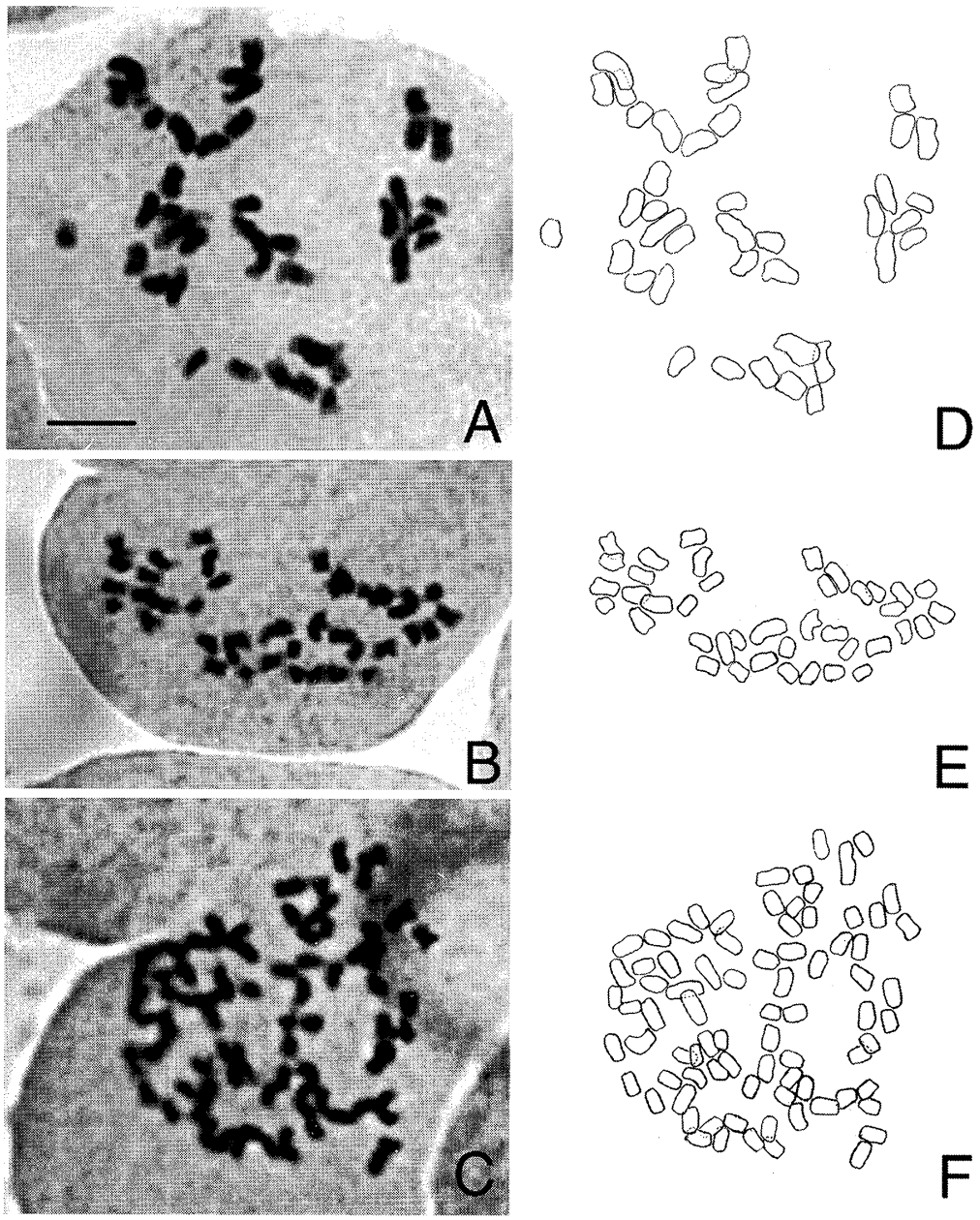

FIG. 1. Somatic metaphase chromosomes of *Cayratia*. A, D: *C. japonica* var. *mollis*, $2n$=40. B, E: *C. trifolia* (Jakarta, Indonesia), $2n$=40. C, F: *C. trifolia* (Kasongan Lama near Palangka Raya, Indonesia), $2n$=80. A, B, C: microphotographs. D, E, F: explanatory drawings of A, B and C, respectively. Scale = 4 μm.

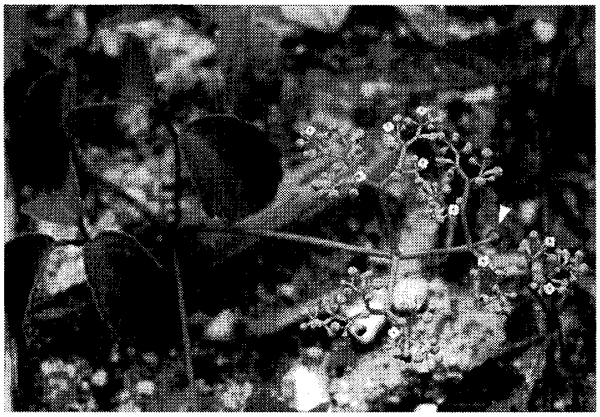

FIG. 2. Tetraploid individual of *Cayratia trifolia* with fruits in natural habitat. Allow shows young fruit. Leaflets in figure about 4 cm in length.

ica var. *mollis*. The tetraploid individual formed fruits in nature (Fig. 2) and had 96% pollen fertility.

Cayratia trifolia is distributed widely in China, Vietnam, Cambodia, Thailand, Myanmar, India, Malaysia, Indonesia and Australia (Jackes 1987, Li 1998). Characters of the leaves are highly variable (Jackes 1987). From molecular phylogenetic analyses, Rossetto *et al.* (2002) agree with Lattif's (1983) claim that both *C. trifolia* and *C. japonica* are quite distinct from all other species of *Cayratia*. It is of interest to know the pattern of distribution and the extent of morphological variation between the diploid and tetraploid members of *C. trifolia* for understanding the evolutionary process of polyploidization in *Cayratia*. Grant (1981) discussed the relationships between frequency of polyploidy and latitude and altitude, and stressed that detailed approaches are required to understand the nature of polyploidy and speciation.

Our study discovered diploid and tetraploid plants of *Cayratia trifolia*, thereby increasing to four the number of intraspecific polyploidy in *Cayratia*. Other species exhibiting intraspecific polyploidy are *C. carnosa* (tetraploid and hexaploid), *C. japonica* var. *japonica* (diploid and triploid), *C. pedata* (diploid and tetraploid) and *C. trifolia* (diploid and tetraploid) (Table 1). Frequent occurrences of intraspecific polyploidy in the same genus are noteworthy. Like *Globba* (Zingiberaceae) (Takano & Okada 2002), *Cayratia* may have a system that frequently induces polyploidization. The high pollen fertility in the tetraploid individual of *C. trifolia* suggests its specific distinction from the

TABLE 1. Chromosome numbers in *Cayratia* showing intraspecific polyploidy with basic chromosome number 20.

Species	*n*	2*n*	ploidy	authors
C. carnosa Gagn.				
	40		4*x*	Vatsala (1960), Sidhu *et al.* (1983)
		80	4*x*	Mitra & Datta (1967), Hazra & Sharma (1970), Sarkar *et al.* (1972)
	60		6*x*	Patil *et al.* (1980)
C. japonica (Thunb.) Gagn. var. *japonica*				
		40	2*x*	Huang *et al.* (1988)
		60	3*x*	Mitsukuri & Hayashi (1953)
	20, 30	40, 60	2*x*, 3*x*	Okada *et al.* (2003a)
C. pedata Gagn.				
	20		2*x*	Patil *et al.* (1980)
	40	80	4*x*	Vatsala (1960)
		80	4*x*	Hazra & Sharma (1970)
	40		4*x*	Sarkar *et al.* (1972)
C. trifolia (L.) Domin				
		40, 80	2*x*, 4*x*	current study

diploid individual and may require taxonomic revision.

Tetraploid and hexaploid individuals of *Cayratia carnosa* and tetraploid individuals of *C. pedata* are believed to form fertile seeds as in the tetraploid *C. trifolia* (Fig. 2), since they exhibit even ploidy. In *C. japonica*, with rare exceptions, triploid individuals do not form fruits because of abnormal chromosome pairing architecture at meiosis I (Okada *et al.* 2003a). The finding of a tetraploid individual of *C. trifolia* suggests the possibility that triploids may be formed from hybridizations between tetraploid and diploid parents. Further tetraploid individuals of *Cayratia* may provide important clues for understanding the origin of triploid *C. japonica*.

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